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Estimating forest age and site productivity using time series of 3D remote sensing data

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Abstract

Three-dimensional (3D) data about forest captured by airborne laser scanning (ALS) have revolutionized forest management planning. Accurate, updated large-scale maps of forest variables produced with low costs today support greatly improved decisions about silvicultural treatments compared to the past practice based on field surveyed data only. These maps usually lack important information about forest age and site productivity, as this cannot be accurately assessed from the available ALS data. In Sweden, ALS has recently been performed nation-wide, except the mountainous area, to produce a new and accurate digital terrain model (DTM). This DTM enables extremely cost-efficient extraction of 3D data about the forest from other sources than ALS, such as automatic stereo-matching of aerial images as well as from single-pass spaceborne interferometric synthetic aperture radar (InSAR). In contrast to ALS, these data sources can provide low-cost time-series of 3D data. Aerial images of Sweden are often available in archives back to approximately 1960, and the TanDEM-X SAR system has the potential to provide new data every second week over large areas. These data have a potentially high value for forest management planning, since they may provide missing and highly important information - forest site productivity, Site Index (SI) and forest age. This pilot study explores a least-squares minimization approach to estimate forest age and SI from time series of 3D data produced by 1) image matching of DMC aerial images, and 2) TanDEM-X SAR data.

Keywords

Forestry; site index; 3D data; aerial photography; radar